

CLAIMS

1. A secondary battery comprising a negative electrode, a positive electrode and an electrolyte, wherein:

the negative electrode includes a negative electrode material capable of occluding and releasing light metal in an ionic state while the light metal precipitates in the negative electrode in a state where an open circuit voltage is lower than an overcharge voltage.

2. A secondary battery as claimed in claim 1, wherein lithium (Li) is contained in the light metal.

3. A secondary battery as claimed in claim 2, wherein lithium precipitates in the negative electrode in one part of a range where the open circuit voltage is from 0 V to 4.2 V, both inclusive.

4. A secondary battery as claimed in claim 2, wherein a peak attributed to lithium ion and a peak attributed to lithium metal are obtained when measuring the negative electrode material in a full-charged state by a ^7Li polynuclear species nuclear magnetic resonance spectroscopy.

5. A secondary battery as claimed in claim 4, wherein the peak attributed to lithium ion measured in the full-charged state disappears when measuring the negative electrode material in a complete-discharged state by

the ^7Li polynuclear species nuclear magnetic resonance spectroscopy.

6. A secondary battery as claimed in claim 1, wherein the light metal precipitates in the negative electrode material.

7. A secondary battery as claimed in claim 1, wherein the maximum amount of the light metal precipitating in the negative electrode is from 0.05 to 3.0 times, both inclusive, the ability of charging capacity of the negative electrode material when the open circuit voltage is the maximum before reaching the overcharge voltage.

8. A secondary battery as claimed in claim 1, wherein the ability of charging capacity of the negative electrode material is 150 mAh/g and more.

9. A secondary battery as claimed in claim 1, wherein the negative electrode has a negative electrode mixture layer containing the negative electrode material and the thickness of the negative electrode mixture layer is from 10 μm to 300 μm , both inclusive.

10. A secondary battery as claimed in claim 1, wherein the negative electrode material contains 50 percent by volume and more of a negative electrode active material.

11. A secondary battery as claimed in claim 1, wherein the negative electrode contains a carbonaceous material as the negative electrode material.

12. A secondary battery as claimed in claim 1, wherein the positive electrode contains an oxide containing the light metal.

13. A secondary battery as claimed in claim 1, wherein the positive electrode contains metallic carbonate.

14. A secondary battery as claimed in claim 13, wherein the metallic carbonate is lithium carbonate.

15. A secondary battery as claimed in claim 1, wherein the electrolyte contains at least either one of ethylene carbonate or propylene carbonate.

16. A secondary battery as claimed in claim 15, wherein the electrolyte contains a non-aqueous solvent which contains propylene carbonate with a concentration of less than 30 percent by volume.

17. A secondary battery as claimed in claim 15, wherein the electrolyte contains ethylene carbonate and propylene carbonate and a mass fraction of mixing ethylene carbonate to propylene carbonate (ethylene carbonate/propylene carbonate) is 0.5 and more.

18. A secondary battery as claimed in claim 1, wherein the electrolyte contains at least one kind selected from the group consisting of chain ester carbonate, 2,4-difluoroanisole, and vinylene carbonate.

19. A secondary battery as claimed in claim 18, wherein the electrolyte contains a non-aqueous solvent which contains 2,4-difluoroanisole with a concentration of 15 percent by volume and below.

20. A secondary battery as claimed in claim 18, wherein the electrolyte contains a non-aqueous solvent which contains vinylene carbonate with a concentration of 15 percent by volume and below.

21. A secondary battery as claimed in claim 1, wherein the electrolyte contains ethylene carbonate, propylene carbonate, dimethyl carbonate, and ethyl-methyl carbonate.

22. A secondary battery as claimed in claim 1, wherein the electrolyte contains LiPF_6 .

23. A secondary battery as claimed in claim 1, wherein the electrolyte is in a solid state.

24. A secondary battery comprising a negative electrode, a positive

electrode and an electrolyte, wherein:

a capacity of the negative electrode is expressed by the sum of a capacity which is obtained when occluding and releasing light metal in an ionic state and a capacity which is obtained when precipitating and dissolving light metal.

25. A secondary battery as claimed in claim 24, wherein the negative electrode contains a negative electrode material capable of occluding and releasing light metal in an ionic state

26. A secondary battery as claimed in claim 25, wherein lithium (Li) is contained in the light metal.

27. A secondary battery as claimed in claim 26, wherein a peak attributed to lithium ion and a peak attributed to lithium metal are obtained when measuring the negative electrode material in a full-charged state by a ^7Li polynuclear species nuclear magnetic resonance spectroscopy.

28. A secondary battery as claimed in claim 27, wherein the peak attributed to lithium ion measured in the full-charged state disappears when measuring the negative electrode material in a complete-discharged state by the ^7Li polynuclear species nuclear magnetic resonance spectroscopy.